NOTES ON THE LIFE-HISTORIES OF SOME NOTODONTIDÆ.

By A. S. Packard.

PART I.

As a result of recent studies on the early larval stages of this group I have been led to consider it as on the whole the most generalized or ancestral of all the Bombyces. In their general, simple shape, their lack of tubercles, spines, stripes and spots, the freshly hatched larvæ of Nadata, Gluphisia, (and probably Lophodonta) seem like the nearest allies of the unknown ancestral form from which the group originated, and which was probably most closely related to the Noctuina, from which it seems not improbable that the Bombyces sprang. It is not improbable that the stem-form which gave rise to the Noctuo-Bombyces, may have also given origin to a series of some lost forms which served as connecting links between the Noctuina and Bombycina.

Heretofore our conceptions as to the true sequence of Notodontian genera have been based on somewhat arbitrary and erroneous considerations. It seems to us not unreasonable to place Gluphisia, Nadata, and Lophodonta at the base of the series, and to let the hairy genera Datana and Apatelodes follow; then would come Ichthyura which is both hairy and tubercled. These should be succeeded by Notodonta and its allies, Nerice, Pheosia, Edema and Dasylophia. These would lead up to the group represented by Schizura; Hyparpax and Janassa would connect the foregoing genera with Heterocampa; of the latter group of species, *H. marthesia* would seem to be an annectant form binding the foregoing genera with Cerura, which is perhaps the most modern and specialized genus of the family.

From some ancient forms resembling *Œdemasia concinna*, with its remarkable tubercles and spines, or from Pheosia with its caudal horn, the genus Dryocampa may have sprung, this being the ancestor or founder of the next nearest related family Ceratocampidæ. That the Notodontidæ and Saturniidæ are closely related is also proved by the venation and other characters of the moths, as we shall hereafter hope to show.

Ichthyura inclusa *Hübner.*

As the following account is based on living specimens, it may replace my description in the Proceedings of the Boston Soc. Nat.

Hist., Vol. XXIV, p. 515, which was in part based on alcoholic specimens.

The eggs of this species were received from Mr. W. N. Tallant, of Columbus, O. They were laid July 20th and the larvæ hatched Aug. 10th or 11th. It feeds at first socially on the aspen, eating out patches on the under surface of the leaf.

Egg.—Diameter about 0.6 mm. Hemispherical, rather high; the shell is thin, white (the egg is reddish just before the larvæ hatches). The shell under a Tolles ⅙ inch objective is seen to be covered with minute polygonal cells which are tolerably distinct, with slightly thickened walls.

Larva, stage I.—(Hatched Aug. 10–11. Described two days after hatching, and also from alcoholic specimens of the same brood.) Length 3 mm. The body is rather long, cylindrical, head rounded, but little wider than the body at first before the latter becomes filled out after eating a few days, as later it is no wider than the body; it is shining jet black, and provided with scattered, long, stiff, tapering bristles. The prothoracic and suranal plates are shining brown-black. The former is moderately large, about three times as broad as long, irregularly trapezoidal, narrowing a little behind, and shows no signs of division into two halves; four hairs arise from the front, and four from the hinder edge. The piliferous warts on the thoracic as well as abdominal segments are more or less conical, and *none bear more than a single hair*. The 2d thoracic segment bears two minute median dorsal tubercles, one on each side of the median line of the body, and smaller than those on the third segment, while the next one on each side of the body is larger than the homologous ones on the 3d thoracic segment. The tubercles on the 2d and 3d thoracic segments are arranged across the segment in a straight line, four of them being visible on each side above. On the abdominal segments the four dorsal tubercles are arranged in a more or less curved line, the curve becoming more marked towards the end of the body, until on abdominal segment 8 the curve is almost semicircular. On the first abdominal segment the two median tubercles are *larger than any on the thoracic* segment, and are larger than the subdorsal and lateral ones on the segment in question, and are *decidedly* larger than the homologous ones *on the 2d to 7th abdominal segments*. The four dorsal tubercles on segments 2 to 7 are all of the same size, but *the two on the 8th segment are nearly as large as those on the 1st, and are about twice as large as those on the 7th abdominal segment*: on the *8th* segment, however,

the subdorsal tubercles are nearly as large, but are narrower than the two in the middle. This segment is *slightly humped, and bears a brown spot surrounding the bases of the two twin tubercles, and a similar spot occurs on the 1st abdominal segment.* The four dorsal warts on segment 9 are arranged in a trapezoid, the two in front being one-half as large as the two behind. The upper subdorsal row of tubercles are partly connected by short lines or streaks, and between this and the next row of warts lower down is a broken fine brown line, which is, however, almost obsolete. A fine nearly obsolete (or is it incipient?) dorsal brown line.—In more advanced specimens the body is *plainly striped on each side with three interrupted dark reddish lines.* The piliferous tubercles or warts are dark brown, and give rise all over the body to but *a single hair.* A pair of especially large long hairs arises from the 2d thoracic and 9th abdominal segments. The hairs are long and slender, and though under a low power they appear to be tapering, under a 1/5 objective they are seen to be docked or blunt at the end and some at least slightly but distinctly bulbous at the tip; they are also seen to be hollow and truly glandular, the end appears to be flattened, as seen sideways the hairs appear to taper. The hairs vary much in length, some being longer than the body is thick. An unusual, if not unique feature, exceptional among Bombycid larvæ in the first stage is the microscopic hirsuties clothing the body. Under a 1/5 objective the microscopic hairs are very short, quite uniform in length, very dense, and taper to a point.

The suranal plate is distinct, blackish, nearly as long as broad, rounded triangular, and bears on the edge 8 piliferous warts of nearly equal size, besides two arising from the surface, a little in front of the middle. The spiracles are round and remarkably small.

The thoracic legs are black, and at the end near the claw are two tenant hairs which are long and large, curved backward and somewhat knife-shaped. The abdominal legs have a black chitinous scale on the outside above the planta. These are at first crotchets.

The general color of the body is deep straw-yellow with a greenish tinge and a waxy appearance or gloss on the skin, while the obscurely marked stripes are reddish.

Stage II.—Length 5–6 mm. Aug. 18–20. Now the generic and part of the specific characters are assumed, the species in this stage being easily distinguishable from the others of the genus.

The larvæ still feed socially on the under side of the leaves, in confinement hiding between the leaves in the breeding box.

The head is black, as wide as the body. The prothoracic shield is pitch-black, and now is *divided by a pale median line*. The body is bright yellowish-green. There are *three dorsal dark brown lines*, the median less broken than the others. The *three lateral lines are now distinct*, the middle one being one-half as wide as the others, the two others bearing the larger subdorsal and lateral tubercles respectively. The situation and relative proportion in size of the tubercles (which are dark) are as described in Stage I; the two large twin dorsal pairs on abdominal segments 1 and 8 are *larger, higher and more distinct than before, and each bears about four or five stiff, dark bristles of unequal size and length*. The suranal plate is blackish. The hairs are now slender, pale or dull whitish, tapering, and in general about as long as the body is thick. The legs as before, but the abdominal ones with a larger and rather more distinct squarish chitinous patch above the planta. (Described soon after moulting).

Stage III.—(Described Aug. 29, immediately after moulting). Length, 12 mm. The head is now not so wide as the body, black. The prothoracic shield is distinctly divided. Body bright, glistening, yellowish-green, with three narrow dorsal black lines, the median one less broken than the others. These are succeeded by a broad diffuse subdorsal, almost double black stripe, on which a black piliferous wart is situated, one for each segment. Below is a similar wart—including broad line, and above and below this is a fine black-brown, somewhat broken line; the lower one is the spiracular line, the dark spiracles being minute and interrupting the line, so that *there are four instead of three lateral lines in this stage;* the additional line being the lowest or spiracular one.

The two large twin tubercles on the 1st and 8th abdominal segments arise from a common fleshy hump, that on the 8th segment being slightly the smaller of the two pairs. Each bear 6–7 black hairs. The hairs are in general sordid white, and are not so long as the body is thick. The suranal plate is large, black, and the anal legs are nearly all black on the sides.

Recapitulation. (Corrected from that published in Proc. Bost. Soc., xxiv. 517).

In stage I the two median dorsal tubercles on the 1st and 8th abdominal segments are larger than the homologous ones on the 2d to 7th abdominal segments, and each pair is situated on a brown raised ground.

The prothoracic shield is undivided; in stage II it begins to be divided, becoming separate in their last stages.

3. Toward the end of the stage the three lateral lines are indicated.

4. The hairs in stage I are glandular and slightly bulbous.

5. The tubercles in stage I all give rise to but a single hair.

6. The three dorsal dark reddish lines appear at the end of stage II.

7. The spiracular line appears in stage III.

Ichthyura vau *Fitch.*

The young larva was found feeding on the aspen at Brunswick, Me., and moulted Aug. 10–12, when it became 10 mm. in length.

Young larva in 3d stage.—Length, 10 mm. Head black. The body is on the sides and at the end livid dark brown. The warts and humps on the 1st thoracic, and 1st and 8th abdominal segments are of the same color, but the other piliferous dorsal warts are yellow. There are four parallel whitish-gray dorsal lines, or rather three dark, livid-brown, fine dorsal lines on a grayish-white field.

Last stage.—Length 25 mm. Head brown-black, flattened, as wide as the body; with gray hairs. The prothoracic plate is widely divided into two transversely oval brown-black plates. The body is marked with a broad, dorsal, ash-gray band, containing three vandyke-brown more or less broken lines. The sides of the body darker and containing two darker, irregular, broken lines. On the 1st thoracic segment are no dorsal yellow warts, but two on each side, the upper one in front of the spiracle, button-like, prominent. On the 2d and 3d thoracic segments are four yellow tubercles, forming a transverse series. On the 2d to 8th abdominal segments the yellow warts are arranged in a very low trapezoid, and the two anterior ones are minute. Those on the 9th segment form a curved line. The suranal plate is broad and rounded, speckled with black. There are no humps or specialized warts on the 1st and 8th abdominal segments, thus differing from the larva of *I. inclusa*. The thoracic legs are blackish; the abdominal and anal legs livid ash.

The larva differs decidedly from that of *I. inclusa*, though the moth is nearly allied.

Ichthyura albosigma *Fitch.*

The following description is drawn up from Mr. Bridgham's colored drawings of the three last stages, and an alcoholic specimen of the mature larva. It occurred on the poplar, July 9 to 13, those in the three last stages occurring at these dates. Other specimens were reared by Mr. Bridgham and the moths obtained from them.

Larva in stage III.—Length, 26 mm. Head as wide as the body, reddish. The body reddish on the sides, and green along the back, interrupted by a reddish patch on 1st and one on the 8th abdominal segments, each of which encloses a median tubercle. The green back encloses three parallel dark-green, indistinct, interrupted lines. There are two greenish tubercles on the side of the body, one above and the other below the spiracle.

Stage IV.—Length, 30 mm. The hair is still reddish, but the body has now lost its green shade on the back, which is pale, with three darker parallel dorsal lines. The two median tubercles are now as well developed as in the last stage. The side of the body is pale reddish, with dark lateral tubercles on the thoracic and 1st abdominal segments; those on the succeeding segments being yellowish, as on the abdominal legs, including the anal pair and suranal plate. The thoracic legs are pale.

Full-fed Larva.—Length, 30 mm. Head hardly as wide as the body, black, with a y-shaped, pale-brown line in front, formed of a median line extending down from the vertex to the apex of the clypeus, and then dividing so as to extend down on each side, ending before reaching the antennæ. The head is flattened and densely covered with grayish hairs. The three thoracic segments bear each six lateral rather large, yellowish warts, the lowest one the largest, each bearing about 6 or 7 hairs of unequal length. There is a high median finger-shaped, fleshy nutant black tubercle on the 1st abdominal segment, bearing numerous short, unequal hairs; it is rather high, finger-shaped, and bent over backwards. On the 8th segment is a shorter, smaller, paler one. *It is evidently of double origin*, its longest diameter being transverse to the body, and somewhat wedge-shaped; the end is somewhat swollen on each side, with a slight valley between the swellings, showing that it was originally formed of two separate tubercles, and this is also suggested by the fact that each swelling bears eight or ten short unequal hairs. The thoracic legs are black; the abdominal legs are dark, especially towards the planta.

Colors : (described from Bridgham's figure) Body straw-yellow, with three dorsal, more or less interrupted grayish or pearly pale-brown lines, and a broad lateral stripe, below which the tubercles are yellow-ochreous. The suranal plate is flattened, rounded in outline and hairy, with the surface rather rough and hairy. In my single alcoholic specimen there is no sign of a prothoracic shield or plate.

Although the imago of *I. vau* is very near that of *I. inclusa* in markings, the larva is very different, there being no median dorsal tubercle on the 1st abdominal segment. In the lack of these tubercles *I. strigosa* resembles *I. vau*. On the other hand, the larva of *I. albosigma*, in respect to the presence of the two dorsal abdominal tubercles approaches that of *I. inclusa ;* these two species, then, as larvæ, belong to the same genus ; while the two other species (*vau* and *strigosa*), as respects the larvæ, differ generically from *inclusa* and *albosigma*, though the moths are congeneric. It is evident that the larvæ of *vau* and *strigosa* are more generalized, since they lack the rather highly specialized dorsal tubercles, so prominent in the two other species of the genus. If we regarded the moths alone we might erroneously consider that *vau* and *inclusa* were both coeval, whereas *vau* must be a much older, more generalized form ; hence, speculations on the phylogeny of Lepidoptera based on the imagines alone, may often be uncertain. (For a brief description of the larva of *I. strigosa*, see our Forest Insects, 453, and Bull. 13 Div. Ent. U. S. Dept. Agr. 30.)

The larva of our *I. albosigma* is closely allied in shape, and in the two dorsal abdominal dark tubercles to the European *I. reclusa*, except that the tubercles in the American species are much larger and more prominent.

A considerable number of the Beaver parasite, *Platypsylla castoris* have been distributed by Mr. G. Beyer, who obtained them by beating dried beaver skins, which were sent to him from Nebraska. A few specimens of the rare *Leptinus validus* were also found in the same manner.

Mr. G. D. Bradford and Mr. Wm. Schaus, both members of our Society, are at present on a collecting trip. The former went to Egypt last January and the latter recently went to Florida. No doubt, both will return with many rare and interesting species.